

Appln No. 10/688,781
Amdt date November 8, 2006
Reply to Office action of August 9, 2006

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Please amend claims 1, 3, 5, 9, 11 and 14, and cancel claims 2 and 10.

1. (Currently Amended) A negative electrode for a lithium sulfur battery comprising:
 - a lithium metal;
 - a pre-treatment layer formed on the lithium metal, the pre-treatment layer having a thickness of 50 to 5000Å and including a lithium ion conductive material with an ionic conductivity of at least 1×10^{-10} S/cm, wherein the lithium ion conductive material is Li_xPO_y , where $2 < x < 4$ and $3 < y < 5$; and
 - a protection layer for the lithium metal.
2. (Canceled).
3. (Currently Amended) The negative electrode of claim [[2]] 1, wherein the lithium ion conductive material is Li_3PO_4 .
4. (Original) The negative electrode of claim 1, wherein the ionic conductivity of the lithium ion conductive material ranges from 1×10^{-10} S/cm to 1×10^{-6} S/cm.
5. (Currently Amended) ~~The negative electrode of claim 1~~ A negative electrode for a lithium sulfur battery comprising:
 - a lithium metal;

a pre-treatment layer formed on the lithium metal, the pre-treatment layer having a thickness of 50 to 5000Å and including a lithium ion conductive material with an ionic conductivity of at least 1×10^{-10} S/cm; and

a protection layer for the lithium metal, ~~wherein the protection layer for the lithium metal comprises~~ comprising $\text{Li}_a\text{PO}_b\text{N}_c$, where a is 2 to 4, b is 3 to 5, and c is 0.1 to 0.9.

6. (Original) The negative electrode of claim 5, wherein the protection layer for the lithium metal comprises $\text{Li}_{2.9}\text{PO}_{3.3}\text{N}_{0.46}$.

7. (Original) The negative electrode of claim 1, wherein the protection layer for the lithium metal has a thickness of 1000Å to 50µm.

8. (Original) The negative electrode of claim 1, wherein the protection layer is formed on the pre-treatment layer.

9. (Currently Amended) A method of preparing a negative electrode for a lithium sulfur battery comprising:

depositing a pre-treatment layer on a lithium metal under an inert gas atmosphere, the pre-treatment layer including a lithium ion conductive material with an ionic conductivity of at least 1×10^{-10} S/cm, wherein the lithium ion conductive material is Li_xPO_y , where $2 < x < 4$ and $3 < y < 5$; and

depositing a protection layer for the lithium metal on the pre-treatment layer.

10. (Canceled).

11. (Currently Amended) The method of claim ~~[[10]]~~ 9, wherein the lithium ion conductive material is Li_3PO_4 .

12. (Original) The method of claim 9, wherein the ionic conductivity of the lithium ion conductive material ranges from 1×10^{-10} S/cm to 1×10^{-6} S/cm.

13. (Original) The method of claim 9, wherein the inert gas is selected from the group consisting of helium gas, neon gas, and argon gas.

14. (Currently Amended) ~~The method of claim 9~~ A method of preparing a negative electrode for a lithium sulfur battery comprising:

depositing a pre-treatment layer on a lithium metal under an inert gas atmosphere, the pre-treatment layer including a lithium ion conductive material with an ionic conductivity of at least 1×10^{-10} S/cm; and

depositing a protection layer for the lithium metal on the pre-treatment layer, wherein the protection layer for the lithium metal comprises $\text{Li}_a\text{PO}_b\text{N}_c$, where a is 2 to 4, b is 3 to 5, and c is 0.1 to 0.9.

15. (Original) The method of claim 14, wherein the protection layer for the lithium metal comprises $\text{Li}_{2.9}\text{PO}_{3.3}\text{N}_{0.46}$.

16. (Original) The method of claim 9, wherein the protection layer for the lithium metal has a thickness of 1000\AA to $50\mu\text{m}$.

17. (Original) A lithium sulfur battery comprising:
a negative electrode comprising a lithium metal, a pre-treatment layer formed on the lithium metal, having a thickness of 50 to 5000\AA and including a lithium ion conductive material with an ionic conductivity of at least 1×10^{-10} S/cm, and a protection layer for the lithium metal;

Appln No. 10/688,781
Amdt date November 8, 2006
Reply to Office action of August 9, 2006

a positive electrode comprising a positive active material selected from the group consisting of elemental sulfur, sulfur-based compounds, and mixtures thereof; and
an electrolyte.

18. (Original) The lithium sulfur battery of claim 17, wherein the lithium ion conductive material is Li_xPO_y , where $2 < x < 4$ and $3 < y < 5$.

19. (Original) The lithium sulfur battery of claim 18, wherein the lithium ion conductive material is Li_3PO_4 .

20. (Original) The lithium sulfur battery of claim 17, wherein the ionic conductivity of the lithium ionic conductive material ranges from 1×10^{-10} S/cm to 1×10^{-6} S/cm.

21. (Original) The lithium sulfur battery of claim 17, wherein the protection layer for the lithium metal comprises $\text{Li}_a\text{PO}_b\text{N}_c$, where a is 2 to 4, b is 3 to 5, and c is 0.1 to 0.9.

22. (Original) The lithium sulfur battery of claim 21, wherein the protection layer for the lithium metal comprises $\text{Li}_{2.9}\text{PO}_{3.3}\text{N}_{0.46}$.

23. (Original) The lithium sulfur battery of claim 17, wherein the protection layer for the lithium metal has a thickness of 1000Å to 50µm.

24. (Original) The lithium sulfur battery of claim 17, wherein the protection layer is formed on the pre-treatment layer.